

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 March 2001 (08.03.2001)

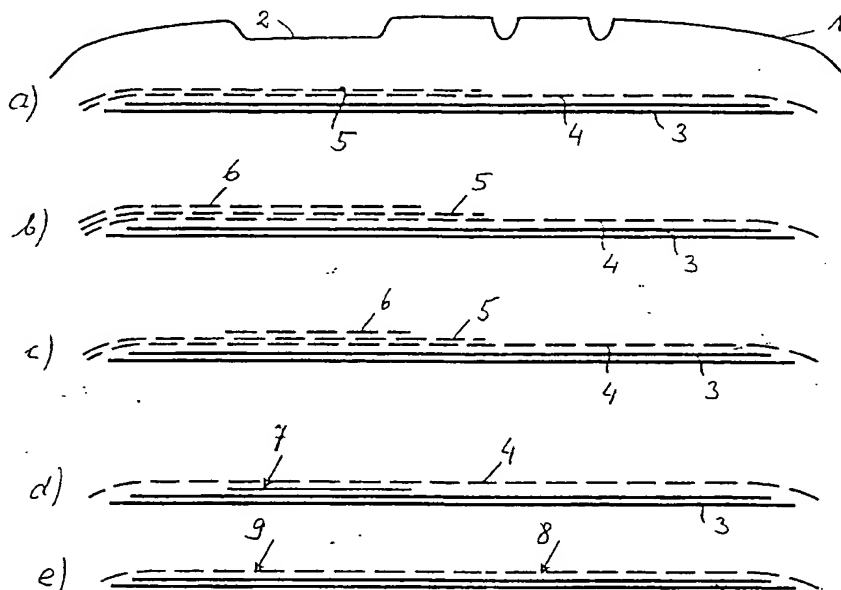
PCT

(10) International Publication Number
WO 01/15918 A1

- (51) International Patent Classification⁷: B60C 11/04,
9/18, 9/20, 9/22, 9/26, 9/30 // 11:00 (DE). WINTER, Hans-Joachim [DE/DE]; Mittler Röde,
D-63571 Gelnhausen (DE).
- (21) International Application Number: PCT/EP00/08331 (74) Agent: STEWART, Charles, Geoffrey; Technical, Dun-
lop Tyres Ltd, Fort Dunlop, Erdington, Birmingham B24
9QT (GB).
- (22) International Filing Date: 26 August 2000 (26.08.2000)
- (25) Filing Language: English (81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (26) Publication Language: English (84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (30) Priority Data:
199 41 339.8 31 August 1999 (31.08.1999) DE
- (71) Applicant (*for all designated States except US*): DUNLOP
GMBH [DE/DE]; Birkenhainer Straße 77, D-63450 Hanau
(DE).
- (72) Inventors; and
(75) Inventors/Applicants (*for US only*): GERRESHEIM,
Manfred [DE/DE]; Darmstädter Strasse 28A, D-63179
Obertshausen (DE). REIHL, Klaus [DE/DE]; Am
Eichenwäldchen, D-63584 Grüdau (DE). MIYABE,
Saburo [JP/DE]; Marienstrasse 2, D-63457 Grossauheim
- Published:
— With international search report.

[Continued on next page]

(54) Title: A VEHICLE TYRE



(57) Abstract: A vehicle tyre is described having at least one carcass ply extending between bead regions, a tread region (1) and a belt arrangement (3) disposed between the carcass and the tread as well as a tread profile provided in the tread region having at least one overwide circumferential groove (2) disposed in particular away from the middle and on the inner side of the tyre, with the tyre region disposed beneath the overwide circumferential groove, which has in particular a width of more than 30 mm, being formed with additional localised reinforcement in the axial direction.

WO 01/15918 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A VEHICLE TYRE

TECHNICAL FIELDS

The invention relates to a vehicle tyre having at least
5 one carcass ply extending between bead regions, a tread
region and a belt arrangement disposed between the
carcass and the tread as well as a tread profile or
pattern provided in the tread region having at least one
10 overwide circumferential groove disposed in particular
away from the middle and on the inner side of the tyre.

BACKGROUND ART

In the design of tread profiles or patterns in the tread
15 region of pneumatic tyres for vehicles, it can be of
advantage for a variety of reasons, particularly for
reasons of tyre noise minimisation or also to improve the
aquaplaning properties, to provide at least one
particularly wide groove extending over the tyre
20 circumference which can be straight or also with waves
and the like. The width of such a groove can be, for
example, a 30 mm or more. However the use of such grooves
in a tread profile can lead to a structural weak spot at
which, when the tyre is in use, an unwanted, higher
25 growth can occur if special measures are not taken.

It is the object of the invention to design a vehicle
tyre of the initially named kind in such a way that, on
the one hand, the advantages arising from the use of
30 overwide circumferential grooves can be used to the full
and, on the other hand, weak spots resulting from the
existence of such grooves can be avoided and even
additional advantages achieved with regard to the
properties of the respective tyre.

DISCLOSURE OF THE INVENTION

Accordingly the object is generally satisfied essentially in that the tyre region disposed beneath the overwide circumferential groove, which has in particular a width of more than 30mm, is made with additional localised reinforcement in the axial direction.

In accordance with a preferred embodiment of the invention, the particularly wide groove is located on the respective inner tyre side, while only such circumferential grooves are provided on the outer tyre side which do not lead to any structural weak spots in the tyre construction.

The additional localised reinforcements to be provided beneath the overwide groove can be realised in different manners in accordance with the invention, with possibilities of combining different solutions also existing.

A first version for the provision of the required local reinforcement comprises the use of at least one additional winding bandage, in particular using a nylon strip, or of an additional strip consisting of an essentially non-extensible material, in particular aramide, beneath such a winding bandage. An asymmetrical tyre construction is thus created which leads to specifically pre-determinable tyre properties.

Another possibility of providing a reinforcement in the region beneath the circumferential groove comprises designing a belt ply arrangement in such a way that cord plies, in particular steel cord plies, are used beneath

the weak spot created by the groove, whose cords extend at a less steep angle towards the direction of the periphery than in the remaining region of the overall belt ply arrangement. This principle can be realised particularly advantageously using part belts. In this way, for example, unwanted growth of the tyre on the inner tyre side, where the overwide groove is positioned, can be avoided at high speeds, while cords are used on the outer tyre side which extend towards the circumferential plane at a lower angle, by means of which the handling properties of the tyre can be improved.

In accordance with another embodiment of the invention, a folded belt arrangement is used in which at least one unfolded steel cord ply is enclosed at least at one side by a folded ply consisting, for example, of aramide, in such a way that the turned-over end of the fold extends so far in the direction of the tyre centre that it spans the region below the groove.

Further possibilities of providing corresponding reinforcement comprise arranging a circumferential rubber strip having a high modulus beneath the groove and preferably directly adjacent to the carcass and/or drawing the turned-over end of at least one carcass ply so far upwards in the direction of the tyre centre and in contact with the carcass ply assembly that said carcass ply end extends over the region beneath the groove. Moreover, the groove base can be, alternatively or additionally, designed to increase stability, for example by means of a convex base shape or by means of a special structure, in particular in the form of angular or rounded elevations projecting in the direction of the circumference.

BRIEF DESCRIPTION OF DRAWINGS

Further advantageous embodiments and features of the invention are given in the dependent claims and are described below with reference to the drawing in which are shown:

- Figure 1 A schematic representation of a tread contour in conjunction with various possibilities of asymmetrical reinforcement by means of winding bandages;
- Figure 2 A schematic representation of a tread contour with various possibilities of providing asymmetrical reinforcements by means of belt ply designs;
- Figure 3 A schematic representation of a tread contour with various possibilities of providing asymmetrical reinforcements using folded belt plies; and
- Figures 4 and 5 A schematic representation of further possibilities to provide asymmetrical reinforcements.

MODE FOR CARRYING OUT THE INVENTION

Figure 1 shows a tread contour 1 having an overwide groove 2 on the inner tyre side. A belt arrangement 3, in particular a two-ply steel cord belt, is provided beneath the tread region and surrounded by at least one strip winding. The winding strips can be wound to overlap, in a spliced manner and/or with pre-determinable spacings.

To reinforce the region of the tyre disposed beneath the groove 2, a partial bandage 5 is provided in version a),

in addition to the full bandage 4 extending over the whole belt ply width, the partial bandage 5 extending from the inside end of the belt ply arrangement 3 to approximately the tyre centre and thus fully spanning the region beneath the groove 2.

In comparison to embodiment version a), version b) is also provided with an additional part bandage 6 which covers the radially inner part bandage 5, but which is led less close to the tyre centre than part bandage 5.

Version c) differs from version b) in that the additional part bandage 6 has a much smaller width than the radially inner part bandage 5 and is located essentially only in the region of the groove, while covering this well, and is not wound up to the inside edge of the belt ply arrangement 3.

In accordance with version d), the required local reinforcement is achieved by a circumferential aramide reinforced strip 7, which is disposed radially within the full bandage 4 and whose width is greater than the width of the groove 2. The mentioned part and full bandages 4, 5, 6 consist preferably of nylon.

The embodiment version e) realises the required reinforcement on the inner side beneath the groove 2 by means of an aramide part bandage 9 which is at least essentially non-extensible; and a conventional nylon-part bandage 8 adjoins this aramide part bandage 9 in the same plane. Versions d) and e) can also be combined with versions a) to c).

Analogue to the schematic representation of Figure 1, Figure 2 shows various possibilities of providing the required asymmetrical reinforcement by means of belt ply designs.

5

In accordance with embodiment version a), the belt ply arrangement comprises a two-part inner belt ply 9 and a one-part radially outer belt ply 10 having a cord angle to the circumferential plane of approximately 15 to 30°, with an additional narrow covering belt ply 12 being provided above the spacing region 11 formed between the two part belt plies 9. These belt plies and part belt plies preferably consist of steel cord plies. The angles selected between the cords of the cord plies and the circumferential plane are indicated in Figure 2 by corresponding reference arrows at 20 to 70° for the belt plies on the inner tyre side and at 15 to 30° on the outer tyre side and for the narrow covering plies respectively. This angle selection ensures the required operating safety of the tyre and additionally produces handling advantages.

25

Version b) differs from version a) in that the radially outer belt ply 10 is made of two part plies.

30

The part belt plies provided in each case can be selected variably in width, with it also being possible to use part belt plies both for the radially inner and for the radially outer belt plies respectively. The location of the spacing region 11 can be selected freely within a large region to influence the tyre properties; however, it should not be disposed beneath the groove 2.

Again analogue to the method of representation of Figures 1 and 2, Figure 3 shows asymmetrical designs realised by belt plies folded at least in part.

- 5 In embodiment version a), a further belt ply, consisting in particular of aramide, is folded at one side around a planar belt ply, consisting in particular of steel cord, with the limb or folded end 14 being led so far inwards that it spans the region of the groove 2. A nylon/winding
10 bandage 15 can be provided at the opposite end of the belt arrangement.

- Version b) shows a C-fold of an aramide belt ply which encloses two planar plies 12, 15, consisting in
15 particular of steel cord and/or aramide. The folded end 14 disposed on the inner tyre side is led further to the centre than the opposite folded end so that the gap region between the folded ends 14 is disposed in the right part of the tyre. The region beneath the groove 2
20 is accordingly supported and reinforced by the longer folded end.

- Version c) differs from version b) essentially by only one planar belt ply being enclosed by the C-fold, with
25 the planar ply preferably consisting of steel cord and the folded ply of aramide.

- Figure 4 shows an embodiment version of the invention in which the reinforcement of the region disposed beneath
30 the groove 2 is realised by a circumferential rubber strip having a high modulus 16 and preferably arranged directly adjacent the carcass ply 17.

In accordance with the embodiment of Figure 5, the reinforcement required beneath the groove 2 is achieved by a turned-over end of at least one carcass ply on that side of the tyre where the overwide groove 2 is located, 5 with the turned-over end being extended so far in the direction of the tyre centre that said carcass ply end 18 spans the region of the groove 2 in the carcass assembly.

REFERENCE NUMERAL LIST

	1	Tread contour
	2	Overwide groove
5	3	Belt arrangement
	4	Full bandage
	5	Part bandage
	6	Part bandage
	7	Aramide ply
10	8	Nylon part bandage
	9	Inner belt ply
	10	Outer belt ply
	11	Spacing region
	12	Steel cord belt ply
15	13	Aramide folded ply
	14	Limb or folded end
	15	Nylon bandage
	16	Rubber strip
	17	Carcass ply
20	18	Carcass ply end

CLAIMS

1. A vehicle tyre having at least one carcass ply extending between bead regions, a tread region (1) and a belt arrangement (3) disposed between the carcass and tread (1) as well as a tread profile provided in the tread region and having at least one overwide circumferential groove (2), especially an overwide circumferential groove disposed away from the middle and on the inner side of the tyre, characterised in that the tyre region disposed beneath the overwide circumferential groove (2) which, in particular, has a width of more than 30 mm, is of reinforced design which is restricted in the axial direction.
2. A tyre in accordance with claim 1, characterised in that at least one wound part bandage (5) is provided as the reinforcement, surrounds the belt arrangement (3) and is in particular wound abutting or with overlap, with the axial length of the part bandage being greater than the width of the groove (2) lying above it.
3. A tyre in accordance with claim 1 or 2, characterised in that the part bandage (5) is arranged above a full bandage (4) covering over the belt arrangement (3) over its full width and extending at one side up to one belt edge.
4. A tyre in accordance with one of the preceding claims, characterised in that the full bandage (4) and the part bandage (5) consist of a nylon winding strip.
5. A tyre in accordance with claim 1, characterised in that an aramide ply or an aramide bandage (7) is provided as the reinforcement and is in particular disposed radially inside a nylon full bandage (4).
6. A tyre in accordance with one of the preceding claims, characterised in that at least two part bandages

(5, 6) of different axial length are arranged above one another.

7. A tyre in accordance with claim 1, characterised in that instead of a full bandage fitted on the belt arrangement (3), a first part bandage (9) consisting of an essentially non-extensible material, in particular aramide, is provided beneath the overwide groove (2) in one tyre half and a second part bandage (8) directly adjoining it, in particular of nylon, is provided in the second tyre half.

8. A tyre in accordance with one of the preceding claims, characterised in that a belt ply arrangement is provided as reinforcement and consists in the region of the groove (2) of two plies with a larger cord angle in comparison to the remaining belt ply region.

9. A tyre in accordance with claim 8, characterised in that the cord angle is disposed in range of about 20° to 90° and in particular in the range from about 20° to about 70° and the cord angle in the remaining belt ply region preferably amounts to about 15° to 30° .

10. A tyre in accordance with claim 8 or claim 9, characterised in that the radially inner belt ply (9) and/or the radially outer belt ply (10) consists of two part plies which are offset relative to the respective neighbouring ply and are disposed with a mutual spacing region (11) in the same plane, with the spacing region (11) being spaced relative to the groove (2).

11. A tyre in accordance with one of the claims 8 to 10, characterised in that a further narrow belt ply (12) is provided in the spacing region (11), the cords of which include an angle with the circumferential plane preferably in the range from about 15° to 30° .

12. A tyre in accordance with one of the preceding claims, characterised in that an asymmetrically formed

folded belt ply arrangement is provided as a reinforcement, with an aramide ply (13) being folded at at least one side about an unfolded steel cord belt ply (12) and one limb or end of the fold (14) extending over
5 the region beneath the groove (2).

13. A tyre in accordance with claim 12, characterised in that the aramide ply (13) is provided in a C-fold with folded ends of dissimilar length and in that an unfolded aramide ply (15) is preferably arranged parallel to the
10 steel cord ply (12) adjoining the latter.

14. A tyre in accordance with claim 1, characterised in that a rubber strip (15) having a high modulus is provided as a reinforcement beneath the groove (2) and adjacent the carcass (17).

15. A tyre in accordance with claim 1, characterised in that at least one end (18) of a carcass ply folded around a bead core is led back up to and into the tread region as a reinforcement and extends in the carcass ply
assembly up to and beyond the region of the groove (2).

20

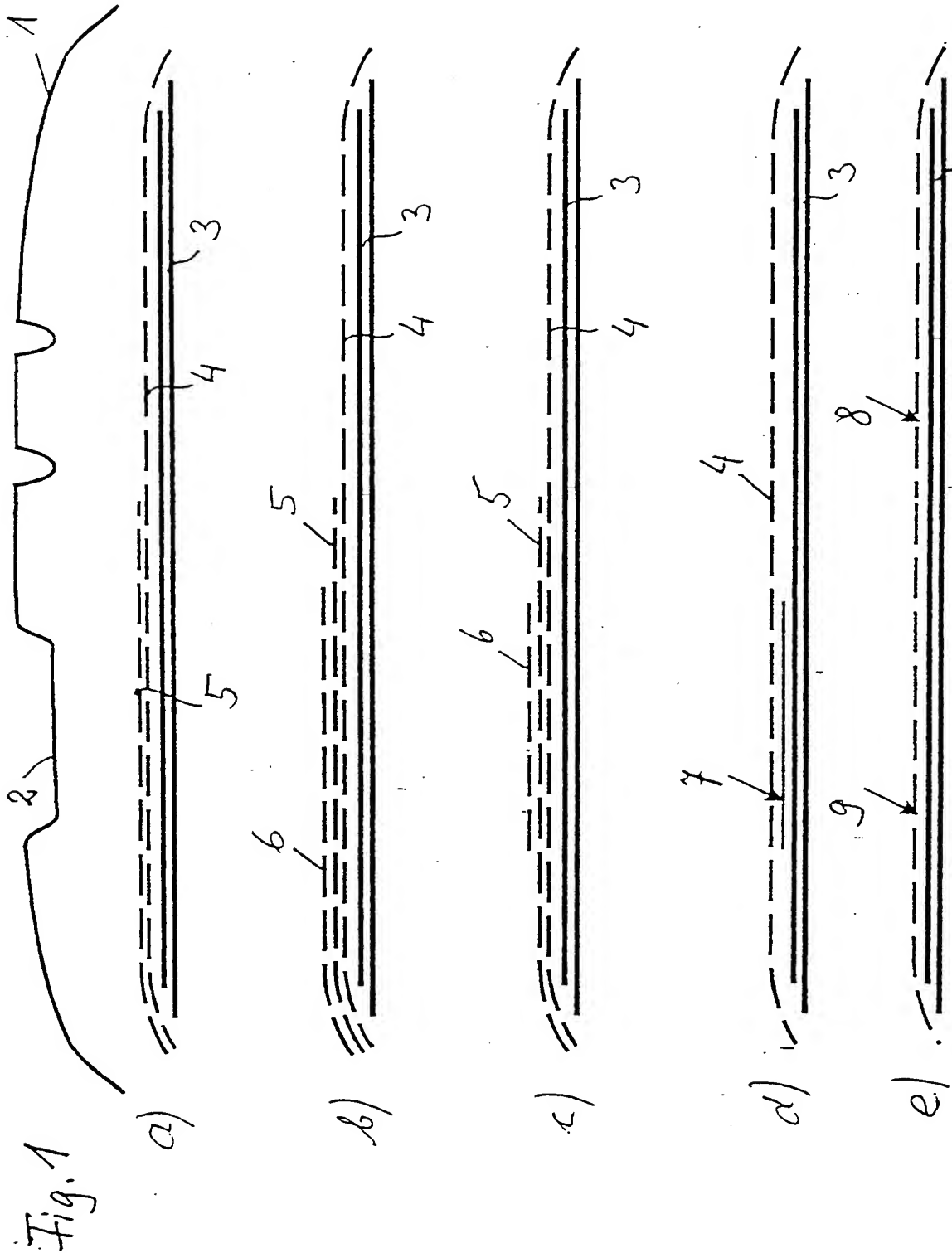
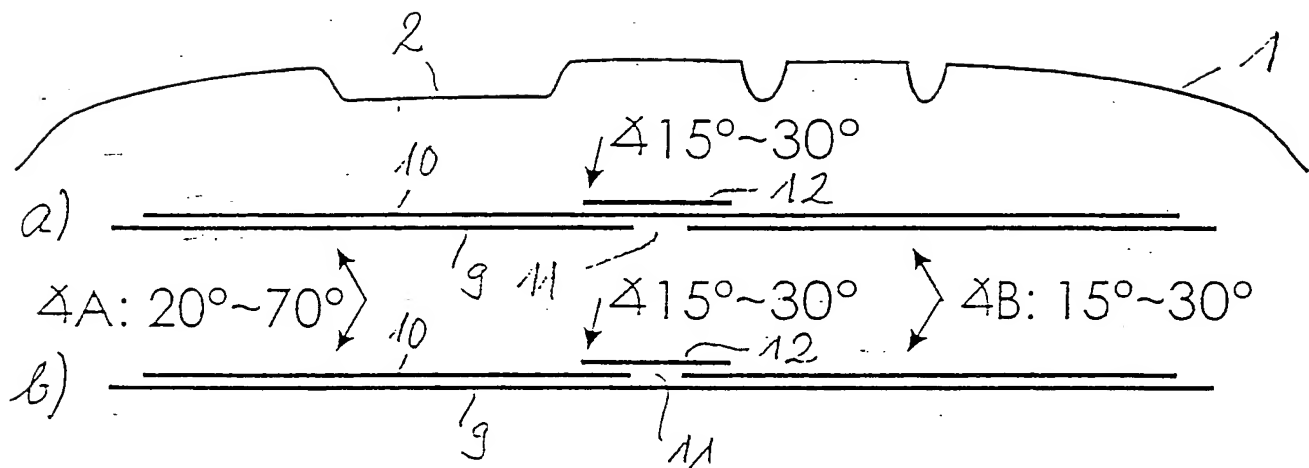
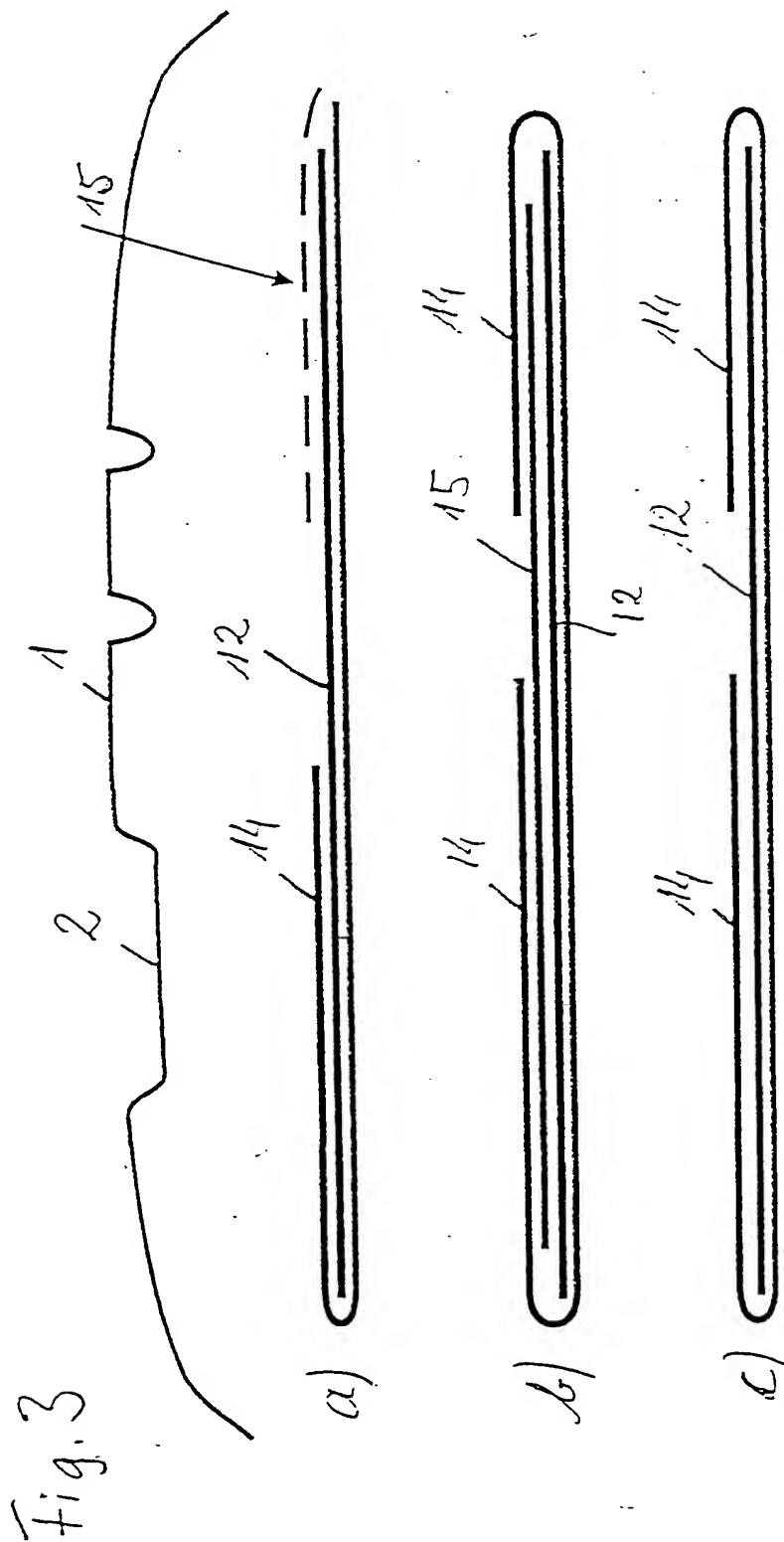
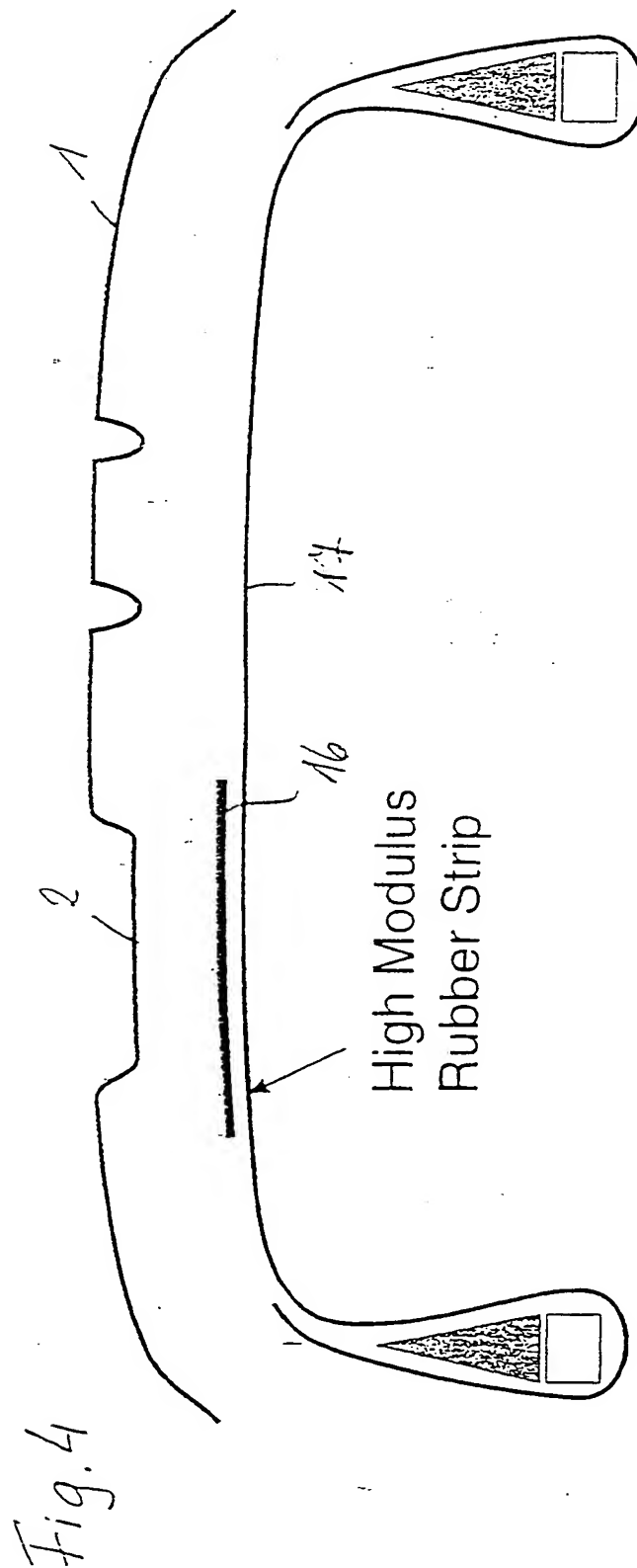


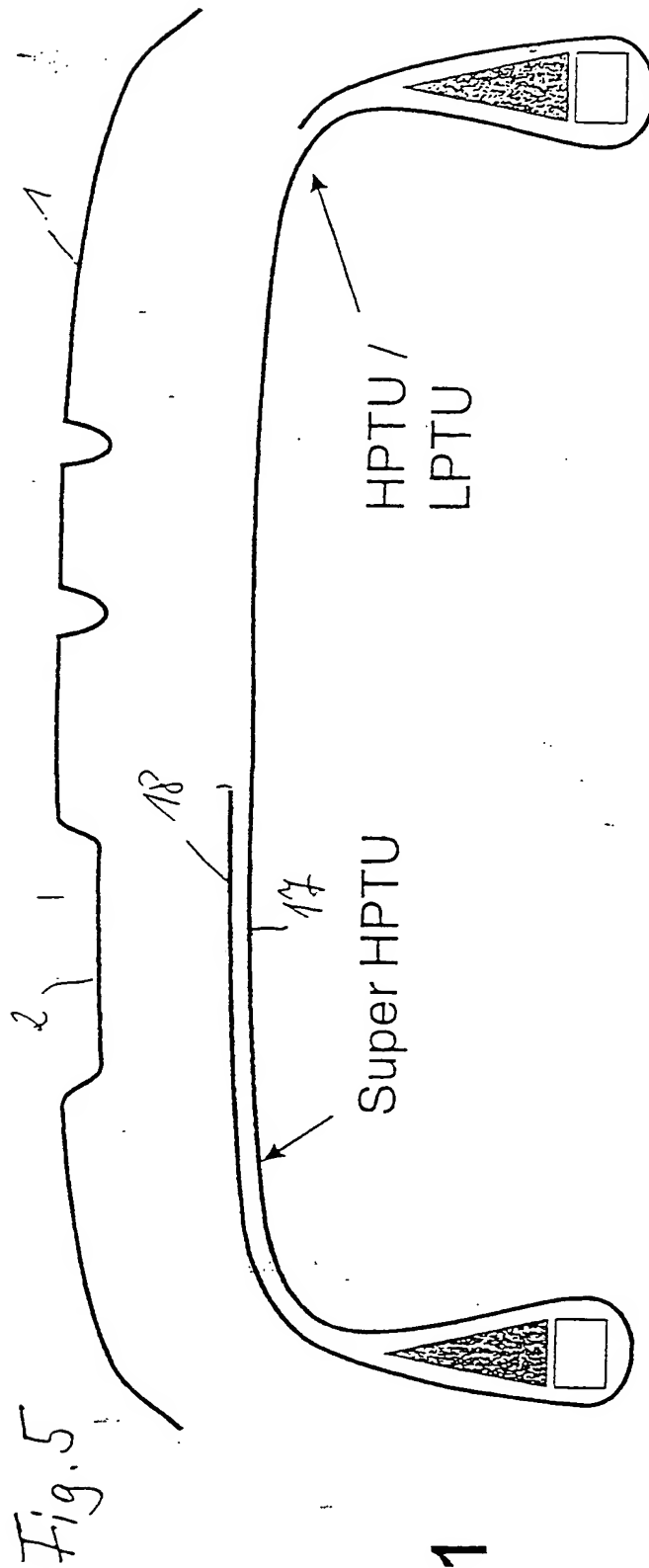
Fig. 2







5/5



INTERNATIONAL SEARCH REPORT

Inte. Jional Application No

PCT/EP 00/08331

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60C11/04 B60C9/18 B60C9/20 B60C9/22 B60C9/26
B60C9/30 //B60C11:00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 453 (M-1662), 24 August 1994 (1994-08-24) -& JP 06 143924 A (YOKOHAMA RUBBER CO LTD:THE), 24 May 1994 (1994-05-24) abstract figure 6	1-4
X	US 3 841 372 A (BOILEAU J) 15 October 1974 (1974-10-15) column 3, line 12 - line 28	1,8-11
A	US 5 759 313 A (SHIRAI KENICHI ET AL) 2 June 1998 (1998-06-02) claims column 4, line 11 - line 23; figures 1-3	1
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

- *X* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

7 December 2000

Date of mailing of the international search report

15/12/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Baradat, J-L

INTERNATIONAL SEARCH REPORT

Int'l. Application No.

PCT/EP 00/08331

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 676 305 A (SUMITOMO RUBBER IND) 11 October 1995 (1995-10-11) page 4, line 17 - line 18 ---	1
A	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) -& JP 08 244408 A (BRIDGESTONE CORP), 24 September 1996 (1996-09-24) abstract ---	1
A	DE 40 32 072 A (CONTINENTAL AG) 16 April 1992 (1992-04-16) claims; figures -----	1-4

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Application No

PCT/EP 00/08331

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 06143924 A	24-05-1994	NONE	
US 3841372 A	15-10-1974	FR 2138542 A AU 4278472 A BE 783697 A CA 960125 A DE 2225803 A ES 403246 A GB 1395532 A IT 958978 B JP 51029282 B LU 65420 A NL 7206787 A, B SE 389475 B ZA 7203612 A	05-01-1973 03-01-1974 20-11-1972 31-12-1974 07-12-1972 16-04-1975 29-05-1975 30-10-1973 24-08-1976 22-01-1973 29-11-1972 08-11-1976 26-09-1973
US 5759313 A	02-06-1998	JP 9024707 A DE 19621553 A FR 2736591 A	28-01-1997 16-01-1997 17-01-1997
EP 0676305 A	11-10-1995	DE 69503547 D DE 69503547 T JP 2966759 B JP 7329515 A US 6119745 A	27-08-1998 19-11-1998 25-10-1999 19-12-1995 19-09-2000
JP 08244408 A	24-09-1996	NONE	
DE 4032072 A	16-04-1992	NONE	